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Suppliers' Information Note

For The BT Network

Pre-Digital Phone Line (PDPL)

Technical Characteristics of the:

PDPL Single Analogue Line Interface, Supplementary Services Set & Withdrawal Notification

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1. Introduction & Scope

This Suppliers' Information Note (SIN) covers the *BT Pre-Digital Phone Line* (*PDPL*) *service* and specifies the technical characteristics of the PDPL single analogue line interface. The physical access line of the PDPL service is provided by the Openreach product SOTAP for Analogue (*Single Order Transitional Access Product for Analogue*) as described *within* Openreach SIN 349 Metallic Path Facility (MPF) [17]. The SOTAP for Analogue product is delivered to a customer premises and terminates at the Network Termination Point (NTP). The PDPL provides a voice service via the SOTAP analogue line served by an *exchange based* Media Gateway (MGW) interface into a core IP network infrastructure. The customer call set-up signalling is mapped into the Session Initiation Protocol (SIP).

The PDPL service is being introduced by BT as a transitional, interim product to enable the migration of a minority of PSTN lines to an alternative line powered voice service as the PSTN is withdrawn. **The PDPL service itself is due to be withdrawn nationally by March 2031, or in line with SOTAP for Analogue local withdrawal (e.g. for BT exchanges closing before the end of 2030), whichever is sooner.**

The lines migrated to PDPL service will be for users requiring only a voice service or vulnerable users using certain line powered “Care” products who are unable to transition to a suitable all IP alternative prior to PSTN closure. Other lines migrated will include large numbers of those regarded as Critical National Infrastructure (CNI). This includes a variety of use cases including, Emergency Lift Phones, Network Rail Crossings, Coastguard Emergency and Utility Telemetry applications of many kinds employing the transmission of analogue Voice Band Data (VBD). Such applications use a range of different standards, for example ITU-T and British Standard (BS). Other applications may use non-ITU modems, for example Bell 103, Baudot and DTMF. Others may have been designed to use a propriety implementation. Typical application examples include fluid level monitoring, status reporting and a plethora of remote-control functions in water supply, the environmental and utility sectors and other key industries. Other providers using bespoke control functions reliant on VBD transmission include residential homes in the *Care* sector.

The VBD services supported by PDPL are provided on a ‘reasonable endeavours’ basis (see Annexe B) with support most likely for protocols based on international and ETSI standards. The PDPL service includes support for a sub-set of existing PSTN voice supplementary services inclusive of Call Waiting and Calling Line Identification (CDS) service as currently described in Openreach SIN227 [19].

NOTE 1: The PDPL service is, at launch, a ‘single directory number per line’ service based on a loop calling, unguarded clearing line protocol. The PDPL service does not offer PBX/MLG support (i.e. *Line Hunting*) facilities or any form of Centrex or *virtual* PBX service.

NOTE 2: In cases where the Network Termination Equipment (NTE) is mains powered, the conditions quoted in this SIN apply when mains power is being applied to the NTE. The conditions applicable when mains power is removed from the NTE may be different to those quoted in this SIN.

Much of the information contained in this SIN has been published previously in documents such as other SINs, ETSI Standards and British Standards. *In this case, most of the analogue line interface and impedance characteristics information is derived from* ***Openreach SIN351 [18]*** *which the PDPL product line interface emulates as far as is technically possible.*

Changes to the network that affect the correct working of terminal equipment designed to use the BT PDPL service will be published in BT SINs. If the changes impact on the content of this document then it will be updated.

SINs are available from our www site at

Suppliers' information notes (SINS)

Enquiries relating to the technical content of this document and the availability of SINs should be directed to: **sinet.helpdesk@bt.com**

2. The Network Termination Point

The Openreach network interface providing an '*Access'* to the PDPL service consists of two conductors designated as the 'A' and 'B' wires. The customer access to the Openreach network interface can be either a Openreach Master socket or in the form of an Insulation Displacement Connection (IDC) cable termination.

2.1. Connections Used In Openreach Master Sockets

When the line is terminated on a Openreach Master socket the connections are as shown in the following table.

Table 1: Openreach Master Socket Contacts

1	Not Used for PSTN
2	'A' wire or 'B' wire
3	Local earth when required
4	Shunt connection, when required
5	'B' wire or 'A' wire
6	Not Used for PSTN

Note 1: The shunt connection is derived from the centre point between a 470 kΩ resistor and a 1.8 μF capacitor connected in series across the 'A' and 'B' wires. Additionally there is an over-voltage protection device connected across the 'A' and 'B' wires.

Note 2: Contact pin 6 is adjacent to the latch.

Note 3: Plugs that meet the requirements of BS 6312:Part 1:1994 [1] and wired to correspond with Table 1 will be compatible with the BT provided socket.

2.2. Insulation Displacement Connectors

2.2.1. Extension Wiring Connection

Connections for internal extension wiring to IDC within Openreach PSTN NTE are shown in the following table.

Table 2: NTE IDC Connections for Extension Wiring

1	Not Used for PSTN
2	‘A’ wire or ‘B’ wire
3	Shunt connection (Bell wire)
4	Local Earth when required
5	‘B’ wire or ‘A’ wire
6	Not Used for PSTN

Note 1: The different types of NTE currently deployed within the Openreach *Access* network present from 3 to 6 IDCs for the termination of extension wiring, however, the essential connections, IDC '2', '3' & '5', will always be present and the numbering kept consistent.

Note 2: The numeric designation of IDCs and Master Socket contacts are not the same for each connection (see Section 2.1.), for example, the 'shunt connection' is presented on IDC '3' and at Master Socket contact '4'.

2.2.2. Gauge Of Conductors

Insulation Displacement Connectors (IDC) accept the connection of solid copper conductors between 0.4 mm and 0.63 mm diameter.

3. PDPL Profiles & Line Conditions

3.1. PDPL Profiles

There are two profiles available that can be selected when provisioning a Pre-Digital Phone Line, as listed below:

1) Voice, plus VBD. (Referred to hereafter as the *Mixed* profile).
2) VBD

3.1.1 The Mixed Profile

If the end device predominantly makes and receives voice calls, the *mixed* profile will be most suitable.

When the *mixed* profile is provisioned, the port is established in voice mode and will therefore have a configuration for voice calling, such as echo cancellation enabled and dynamic de-jitter buffers. The codec used is ITU-T G.711 A-law appendix I (Packet Loss Concealment (PLC) with a 20ms packetisation time. Any in-call Dual Tone Multi Frequency (DTMF) tones will be conveyed out of band as RTP Events (IETF RFC 2833/4733).

The *mixed* profile relies on the detection of a VBD signature or answer tone (e.g. 2100 Hz) to adapt the profile to VBD working. When this happens, the de-jitter buffers will transition to fixed mode, PLC disabled, and the echo canceller removed if indicated on the modem answer tone by periodic phase reversals. Once in VBD mode any DTMF tones post answer will be carried in-band i.e. within the payload of ITU-T G.711 A-law. See Section 4.1.1 for more information.

The End-user will not need to manually switch between voice and VBD on the *mixed* profile due to the auto detect feature inherent in the PDPL line interface.

3.1.2 VBD Profile

If the end device predominantly makes and receives VBD calls, the VBD profile will be most suitable. It will be especially beneficial where modem types do not employ a full ITU-T V.25 or Bell 103 startup sequence, for example, and hence allow time for the line interface port to change over to VBD working before data transmission commences.

When the VBD profile is provisioned, the port is established in VBD mode at the outset and programmed to expect modem signals. It does not need to adapt from Voice to VBD mode which can cause a transmission path interruption. Technically, echo cancellation will be enabled, without NLP (Non-Linear Processing), de-jitter buffers will be fixed, PLC disabled and packetisation time will be 20ms. If, however, a modem answer tone is received (*with periodic phase reversals*), the echo canceller will be removed. It is important to note that we still expect voice calls to be delivered with a suitable quality of service on the VBD profile. In VBD mode, any DTMF transmitted post answer will be carried in-band i.e. within the payload of ITU-T G.711 A-law. See Section 4.1.1 for more information

3.1.3 PDPL Voice Codec Support

The PDPL will emulate the BT PSTN and will therefore use ITU-T G.711 A-Law encoding. The PDPL will not support calls setup using G.711 µLaw or G.729 codecs. The PDPL will not support wideband audio, sometimes referred to as High-Definition(HD) voice (e.g. ITU-T G.722).

The ITU-T G.711 A-Law codec, dating back to 1972, is the encoding used in the national PSTN network as all voice conversations are already digitally transmitted. Using this codec therefore implies that the voice samples do not need any transcoding until they reach an IP endpoint that does not support G.711. The G.711 A-Law codec alone has a payload of 64 kbits, but when IP and Ethernet overheads are added, this rises to: ~ 100kbits (with 20ms packetisation).

3.1.4 Fax Support

The PDPL service support for FAX is provided on a ‘reasonable endeavours basis’ only and may not work reliably. A pass-through mode of operation will be supported allowing fax modem signals to transmitted over the media path i.e. within the payload of ITU-T G.711 A-law.

Note: ITU-T T.38 Fax relay is not supported.

3.2. Off-Line DC Condition

During the off-line state the BT network interface will provide the following conditions:

- The potential between the ‘A’ and ‘B’ wires will not exceed 70 V.
- The ‘A’ wire will be positive with respect to the ‘B’ wire.
- The BT network interface will recognise a loop resistance of greater than 10 kΩ between the ‘A’ and ‘B’ wires, on the customer side of the NTP, as an off-line condition.
- When a 100 kΩ resistor is connected across the BT network interface the potential between the ‘A’ and ‘B’ wires will be not less than 15 V.

- The off-line DC voltage may not be continuous e.g. during routine line testing (see section 11.1. Line Test Conditions) or during line testing in response to fault reports. The PDPL *Parked Line* state will also result in periodic DC voltage feed removal for periods of approximately 1000ms.
- The application of a resistance that causes less than 4 mA to flow will not be recognised as an on-line (‘seize’) condition.
- There may not be a through metallic path from the BT network interface to the exchange so that the “battery” and “earth” at the exchange cannot be assumed to be repeated at the BT network interface.
- The conditions applied during automatic line testing routines (*see section 11 Routine Testing Of The Local Network*).

3.3. On-Line DC Condition

During the on-line state the BT network interface will provide the following conditions:

- The BT network interface will recognise a loop resistance of less than 1 kΩ between the ‘A’ and ‘B’ wires, on the customer side of the NTP, as an on-line (‘seize’) condition.
- The DC current provided at the customer side of the NTP will be up to 42 mA at 12.5 V, up to 33.5 mA at 10 V, and will be not less than 25 mA at 9 V.[*]
- PDPL lines will be supported using a standard line feed configuration of nominally 25mA (+/- 1mA).

NOTE: *The PDPL line feed design and configuration is in line with BT’s aim to reduce the line current in the on-line state to improve the energy efficiency of BT network equipment.*

3.4. Line Polarity

The polarity of the BT PDPL network interface will normally be such that the ‘B’ wire is more negative than the ‘A’ wire.

3.5. Network Termination Impedance

3.5.1. Terminal (CPE) Input Impedance

The impedance necessary to satisfactorily terminate the BT PDPL network interface at the NTP so as to prevent instability is represented by the three-element network shown in Figure 1.

A minimum return loss of 12 dB should be achieved by terminal equipment against the three-element network of Figure 1.

Additionally for voice terminal equipment, an echo return loss value of 16 dB should be achieved against the three-element network of Figure 1.

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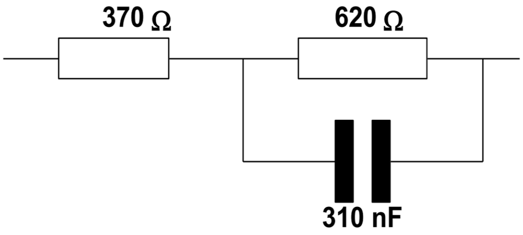
[*] These characteristics are aligned with those of ETS300 001, Chapter 2 Figure 2.3 (GB) [4].

Figure 1: Terminal Complex Impedance Network



3.5.2. PDPL Network Input Impedance

The input impedance of the BT PDPL network at the NTP is represented by a range of impedances comprising the input impedance of the exchange-based Media Gateway (MGW) port, modified by the impedance of a random variety of local cable types/characteristics.

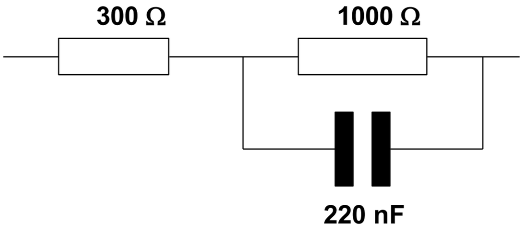
The nominal exchange input impedance is 300 Ω + 1000 Ω || 220 nF (*see Figure 2*).

This may be regarded as the appropriate value for use by terminal designers.

The actual value of the MGW analogue port input impedance may vary due to production and installation tolerances, also the impact of terminal equipment connected at the far end of the circuit on the performance of circuits containing 4-wire loops. A worst-case return loss of 16 dB against the three-element network of Figure 2 can be assumed.

The range of local lines can be represented by between 0 km and 9 km of 0.5 mm copper cable with nominal characteristics of 168 Ω/km and 50 nF/km (attenuation at 1600 Hz of 1.7 dB/km).

Figure 2: BT Network Complex Impedance Network



3.6 PDPL Ground Key Alarm (Earth Contact) Fault Detection Feature

PDPL line interfaces have the capability to detect the *persisted* presence of fault currents to earth on either of the A-Wire or B-Wire of the SOTAP metallic access line. The system reaction to such faults is inhibited until a set line current difference threshold is reached at which point the PDPL line interface is automatically taken out of service with removal of line power. The user's line interface is then periodically monitored for removal of the fault condition after which service is restored automatically. The automatic restoration of service could take up to 40 seconds. Incoming calls to a line with an active Ground Key Alarm will be rejected with a SIP 480 "Temporarily Unavailable" indication. This feature is designed to prevent certain service malfunctions (e.g. Ring Trip) associated with call delivery to a faulty access line.

3.7 PDPL DC Fault Alarm (Foreign Voltage Detection Feature)

PDPL line interfaces have the capability to detect the *persisted* presence of DC Battery (*negative Foreign Voltage*) contacts on either the A-Wire or B-Wire of the SOTAP metallic access line. The system reaction to such faults is inhibited until a set line current difference threshold is reached at which point the PDPL line interface is automatically taken out of service with removal of line power. The user's line interface is then periodically monitored for removal of the fault condition after which service is restored automatically. The automatic restoration of service could take up to 40 seconds. Incoming calls to a line with an active DC Fault Alarm will be rejected with a SIP 480 "Temporarily Unavailable" indication. This feature is designed to prevent certain service malfunctions (e.g. Ring Trip) associated with call delivery to a faulty access line

3.8 PDPL MGW *Local Node* Isolation State

In the extremely rare event that a PDPL Media Gateway node should become isolated from its parent Call Server instance then outgoing call attempts will result in the user hearing *Equipment Engaged Tone* (EET). To clarify, in this situation it will not be possible to support calls between End Users parented on the same MGW node.

This tone is *currently* described in Openreach SIN 350 [3] Network Tones and Announcements.

Note: If the local MGW node becomes isolated as described above, incoming calls will also be rejected with an appropriate supervisory tone or announcement.

4. Signalling Method

The BT network interface will respond to signalling information received from the terminal, either in Multi-Frequency Tone format or Loop Disconnect format.

4.1. DTMF Multi-Frequency Tone Signalling

The BT PDPL network interface will recognise tones meeting all the following conditions as valid digits:

- multi-frequency tones conforming to Table 3, each digit being represented by simultaneous transmission of two frequencies e.g. digit 5 is indicated by 770 Hz + 1336 Hz, and
- combinations of the frequencies given in Table 3 where the tolerance is within ± 1.5 % and the level is within -7 dBm to -13 dBm and with the high frequency at a higher level than the low frequency by between 1 dB and 4 dB, and
- tones that have been applied for a minimum period of 40 ms and with a minimum "tone off" period of 40 ms, and
- the level of any individual unwanted tone in the frequency band 300 Hz to 3,400 Hz has a power level of less than -33 dBm, and
- tones whose accompanying power level outside the frequency band 300 Hz to 3,400 Hz is less than -40 dBm, and
- tones whose accompanying total in-audio-band and out-audio-band unwanted tone power levels are 20 dB less than the lowest power level of any single digit tone.

Table 3: Digit Tone Frequencies

Digits			Low Freqs
1	**2**	**3**	***697 Hz***

	4	**5**	**6**	***770 Hz***
	7	**8**	**9**	***852 Hz***
	*****	**0**	**#**	***941 Hz***
High Freqs	***1209 Hz***	***1336 Hz***	***1477 Hz***	

4.1.1 DTMF Tones Transmitted *Post* Answer

DTMF tones that are transmitted post dialling will be handled on both PDPL profiles for inbound and outbound calls. Both PDPL profiles will also be able to detect the DTMF ABCD digits if sent *Post Answer*.

Mixed Profile

In the *mixed* profile, DTMF digits sent post dialling are handled as IETFRFC2833/4733 Telephone events when the port is working in voice mode. If, however, the port switches to VBD mode, any DTMF digits will be handled as in-band tones as described in the VBD profile.

VBD Profile

The VBD profile will handle DTMF digits sent post dialling as in-band audio tones however there are some technical details associated with the VBD profile that require clarification.

1. Where the PDPL node is the SDP **offeror** to a peer node:
   (a) PDPL node will always indicate support for telephone-events:0-15 in its SDP offer with (default) dynamic payload type (PT)=96
   (b) If the peer does not include support for telephone-events:0-15 in its SDP-answer, then both ends will send DTMF tones **in-band** (i.e. within the payload of ITU-T G.711 A-law**).**
   (c) If the peer does include support for telephone-events:0-15 with PT=x in its SDP-answer,

      - Then the PDPL node will always send DTMF tones **in-band** to its peer (never as telephone-events)

      -If the peer sends DTMF tones as **telephone-events** with PT=x, then the PDPL node will play them out as **in-band** DTMF tones on the user-side analogue interface.

      -If the peer sends DTMF tones as **in-band tones**, then PDPL node will play them out as **in-band** DTMF tones on the user-side analogue interface.

2. If the PDPL node is the **answerer** to an SDP offeror from a peer

   If SDP-offer from the peer includes support for telephone-events:0-15 with PT=x, then the PDPL node will include in its SDP Answer, exactly the same telephone-events support indication.

   -The PDPL node will always send DTMF tones **in-band** to its peer (never as telephone-events).

   -If the peer sends DTMF tones as **telephone-event** with PT=x, then the PDPL node will play them out as **in-band** DTMF tones on the user-side analogue interface.

   - If the peer sends DTMF tones as **in-band**, then then the PDPL node will play them as **in-band** DTMF signals on the user-side analogue interface.

4.2. Loop Disconnect Signalling

The BT PDPL network interface will recognise as valid loop disconnect pulses meeting all of the following conditions:

- Loop disconnect digits at the rate 10 ± 1 pulses per second where the ratio of the break period is 67 +5, -4 % of the overall pulse period, and
- Inter Digit Pauses greater than 240 ms and less than 920 ms, and
- a **break pulse** as a reduction in line current to less 500 μA for a minimum duration of 15 ms, and
- a **make pulse** with a minimum duration of greater than 5 ms, and
- with a pulse shape equivalent to that produced by the shaping circuit of 100 Ω in series with 1.8 μF when subjected to a voltage of between 1 V and 12.5 V (*see Figure 3: Pulse Shaping Circuit*).

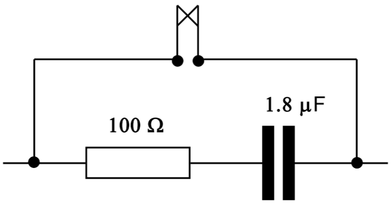


Figure 3: Pulse Shaping Circuit

4.3. Recall

When a call is in the on-line answered state, the BT PDPL network interface will recognise a reduction of the loop current to 1 mA or below, for a period in the range of 53 ms to 103 ms, as a Recall signal.

Note: The Recall signal is used for the control of Supplementary Services as *currently* described in Openreach SIN 354 [2]. The specific sub-set of Supplementary Services that are applicable to the BT PDPL service are listed in Section 9.10 of this SIN.

5. Outgoing Calls

5.1. Call Initiation

The BT PDPL network interface will respond to the application of an on-line ('seize') condition (*see section 3.2 On-line DC Conditions*) that persists for at least 10 ms. After recognition of the call initiation signal by the exchange, Proceed Indication (*see section 5.2 Proceed Indication*) will be returned to the calling customer within 500 ms.

5.2. Proceed Indication

When the BT PDPL network interface is ready to receive routeing information a *Proceed Indication* (Dial Tone) will be provided to the calling terminal.

This tone is *currently* described in Openreach SIN 350 [3] Network Tones and Announcements.

5.3. Call Progress Information

During the progress of a call, a variety of tones and announcements may be encountered. Lists of these are to be found *currently* in Openreach SIN 350 [3] Network Tones and Announcements.

5.4. Call Set-Up Time

The call set-up time figures given below relate to calls routed wholly within the BT network. Calls that are routed outside the BT network (e.g. extended to mobile numbers, into private networks or via direct dialling in lines) may experience longer post dialling delays.

The mean value of call set-up time for the BT PDPL service is expected to be less than 3 seconds, when taking into account the differing levels of call complexity. In addition, 95% of calls are expected to be set up in less than 10 seconds.

6. Incoming Calls

6.1. Call Arrival Indication

Where appropriate, the BT PDPL network interface will provide call arrival indication to any off-line terminal as shown in Annex A: Call Arrival Indication (Ringing).

NOTE: The BT PDPL network interface will support ***Only*** the Standard Call Arrival Indication (Ringing) cadence as per Annexe A

The voltage of the call arrival indication at the NTP will be between 100V and 40V a.c. r.m.s as measured between the 'A' wire and the 'B' wire. A Ringer Equivalence Number (REN - as defined in ETS 300 001, Chapter 3 Section 3.1 (GB) [4]) of (4) will be supported.

> **Note.** The PDPL network interface supports a form of the line interface design that applies the a.c. call arrival indication voltage across the 'A' wire and 'B' wire, rather than between the 'B' wire and earth (*as was the case in the BT PSTN*). The form of call arrival indication used by the BT PDPL network interface is commonly known as ***"Balanced Ringing"***

The Balanced Call Arrival Indication provided by the BT PDPL network interface will always provide a DC voltage bias in the (A-wire) of the interface during the "Active" period of the applied Ringing Cadence. This voltage shall be *nominally* (-20V wrt Earth) and is an essential component in ensuring reliable *Answer Detection* on Balanced Ringing line interfaces especially on long lines. In the ***Passive*** (i.e. *Not Ringing*) cadence periods of the Call Arrival Indication a voltage reversal of the *Idle Line Polarity* conditions will be applied to the A & B wires i.e. the A-Wire shall be negative wrt to the B-Wire (*within the limits specified in section 3.1 Off-line DC Condition*).

Call arrival indication is applied for up to **5 minutes** or until the called customer answers.

NOTE: ***The BT PDPL service will not support any supplementary services where Distinctive Ringing is a requirement of that service***.

6.2. Called Customer Answer

The BT PDPL network interface will recognise the application of the on-line DC condition of section 3.2 as a called party answer, and disconnect ringing.

6.3. Ring Trip

In normal operation, ringing current may continue to be applied for typically 110 ms to 510 ms after the on-line state is established.

7. Call Clearing

Note: Except where stated, the following call clearing conditions are written on the assumption that both ends of the call are connected to a single analogue line interface and the call is connected wholly within the BT network.

7.1. Terminal Initiated Clearing

7.1.1. By The Calling Terminal

When a call is ended by the calling terminal, the BT PDPL network interface will detect an off-line condition (*see section 3.1 Off-Line DC Condition*) and provide the network initiated clearing *(see section 7.2 Network Initiated Clearing*) to the called terminal. Line breaks of less than 200 ms will not be recognised as a clear signal. Line breaks greater than 3s will be recognised as a clear signal (*see section 10.1 Follow-on Call*).

7.1.2. By The Called Terminal

When a call is ended by the called terminal, the BT PDPL network interface will detect an off-line condition *(see section 3.1 Off-line DC Condition*) and initiate a time-out process lasting a nominal ***2 Seconds***. After the time-out period has expired, network initiated clearing (*see section 7.2 Network Initiated Clearing*) is provided to the calling terminal.

Calls that are made to certain services (e.g. Number translation services and Premium rate services) are subject to first party clearing. In these circumstances, when the called terminal ends the call a nominal ***2 Second*** clearing process initiates and the calling terminal is subjected to network initiated clearing (*see section 7.2 Network Initiated Clearing*) immediately.

7.2. Network Initiated Clearing

The BT PDPL network interface will provide a sequence of clearing signals at the NTP as a result of terminals ending a call or when terminals fail to present valid digits during call set-up.

This will typically consist of:

a) an 'end-of-call' signal of between 90 ms and 130 ms

b) Number unobtainable tone (NUT) of duration 20 Secs (see Note 2)

c) Silence of duration 30 Secs

d) application of the *PDPL specific* Howler Tone of duration 180 Secs

and will end with the Parked Line State (*see section 7.3 Parked State*).

Note 1: All duration times stated above are approximate.

Depending on the exact call scenario, the above listed sequence order may vary and supervisory tones other than NUT may be played at point b) above e.g. Busy Tone, Congestion Tone etc.

Note 2: (NUT is *currently* described in Openreach SIN 350 [3] Network Tones and Announcements).

Note 3: The 'end-of-call' signal is sometimes known as the "K-break" signal. It offers a positive way for automatic terminal equipment to determine when either a calling terminal or the BT network interface has resumed the off-line condition. The signal consists of a disconnection or a reduction in the loop current to below 1 mA for the time period stated.

Note 4: There are certain interfaces supported by non-copper access systems that cannot provide the ‘end-of-call’ signal.

7.3. Parked Line State

In the PDPL service as with the BT PSTN there are a number of scenarios and sequences that may result in a user’s access line being put into the “*Parked Line State*” automatically by the system.

When a terminal remains on-line, and has failed to offer a valid digit (*see section 5.1 Call Initiation*) or has failed to achieve the off-line state after call clearing (*see section 7 Call Clearing*), The PDPL system sequences leading to a user line being put into a “Parked State” include the application of the “Howler” indication (*see section 9.4 Howler*). The intention of the Howler being to alert the user to the situation by a distinct high level audible cadenced tone designed with an “*urgency characteristic*” sufficient to encourage a user to replace the handset.

A prolonged failure to restore a handset to the On-Hook state will result in the user’s line being put into the “*Parked Line State*”. The PDPL Parked Line State differs from the BT PSTN parked state (*where a reduced line feed power is continually provided*). In the case of the PDPL *Parked state* the line power feed is ***not continuous*** but is instead applied periodically (every 1500ms) for 500ms (to facilitate detection of a user On-Hook) event. Both these periods are approximate. This mechanism constitutes a compromise of prompt On-Hook detection and significant power saving.

8. Supervisory Signals

Supervisory signals provided at the BT network interface are *currently* described in Openreach SIN 350 [3] Network Tones and Announcements.

9. Additional Information

9.1. Transients

Change of line conditions (for example, polarity, voltage, speech band levels, feeding resistances, and current interruptions) may occur during processing of a call by the network.

9.2. Announcements

At various stages of BT PDPL calls it is possible for announcements to be connected. Announcements are described in Openreach SIN 350 [3] Network Tones and Announcements.

9.3. Noise, Induced Voltages and Line Surges

The BT network interface conditions described in this SIN are those encountered when there is no interference and the earth potential at the local exchange/MGW and the NTP is the same. In practice these conditions may be modified as follows.

Permanent longitudinal direct voltages up to 4 V may exist on the line.

Permanent longitudinal alternating voltages up to 5V r.m.s. 50Hz, and associated harmonics, may exist on the line. Additionally, there may be an earth potential difference up to 3V r.m.s. 50Hz.

Permanent longitudinal and transverse alternating voltages, which generally do not exceed 3V r.m.s., at other frequencies up to 2 MHz may exist on the line. These are generally noise voltages, but between 200 kHz and 2 MHz they may be amplitude modulated and be as a result of radio broadcast signals.

Uniform spectrum and random noise having a power of -42 dBm in the frequency range 300 Hz to 3400 Hz may exist on the line, with random impulsive noise in excess of -22 dBm. Also, other types of random transmission impairment may occur, such as interruptions, phase changes, phase jitter and gain changes.

9.4. Howler

Significance	Range of levels received at BT network interface	Signal composition	Cadence
To draw attention to a telephone left on-line. May be applied to attachments which hold after the distant end has cleared or after an unsuccessful call. The *PDPL Howler* ***is*** applied *automatically*, and will be started ***approximately*** (50-60) seconds after a Caller has failed to Dial or failed to *Clear* down after an unsuccessful call.	**NOTE:** Each *component* of the Howler Tone in the *sequence* shown below is delivered at a level of +15dBm into 600Ω.	Multi-audio frequency, delivered as a *sequence* of individually applied audible tones.	***Continuous Sequence*** lasting **180 Seconds** or until line release if this occurs first.

Table 4: PDPL Howler Characteristics

The PDPL "Howler" characteristics differ from those used on the BT PSTN but are nonetheless "distinctive". The design intention being to alert the user via application of a high level audible cadenced tone designed with an "*urgency characteristic*" sufficient to encourage a user to replace the handset. The PDPL Howler tone levels are broadly equivalent to those used on the BT PSTN but the upper frequency (2000Hz) being lower and hence subject to a lesser line attenuation will result in an increased received volume on longer lines.

NOTE 1: If the user fails to replace the handset during the period the Howler is applied the line will be put into the *Line Parked State* (Section 7.3) immediately on Howler cessation.

The PDPL Howler characteristics in terms of frequency and duration are as shown below:

500Hz (500ms), 1000Hz (500ms), 1500Hz (500ms), 2000Hz (500ms) : (Repeat Sequence)

NOTE 2: Each Tone in the above sequence is delivered at a level of +15dBm into 600Ω.

9.5. End-To-End Insertion Loss

The end-to-end insertion loss at 800 Hz between 600 Ω resistances terminating two BT PDPL network interfaces and routed wholly within the BT network is between 6 dB and 30 dB.

Note 1: These values apply only to calls where both ends are connected to a single analogue line interface and the call is connected wholly within the BT network.

Note 2: Local line attenuation that exceeds 10 dB at 1600 Hz will be compensated within the PDPL line interface so that the attenuation planning limit of 10 dB is not exceeded. However this does not compensate for the ‘additional’ loss/frequency distortion.

Note 3: PDPL line interface ports are designed to support lines with up to 15dB loss at 1600 Hz. The intention being that a PDPL line interface should replicate the BT PSTN in this respect. *However, at first release (October 2024) line migrations will be confined to access lines whose 1600Hz loss does not exceed 10dB while the testing programme continues to confirm acceptable performance on the longer lines up to 15dB.*

9.6. Loss/Frequency Response

The loss/frequency response of BT’s core network connecting its local exchanges conforms to ITU-T G.712 [5]: Figure 3.

Table 5: Core Network 2-wire to 2-wire Insertion Loss/Frequency Response

Frequency (Hz)	10	200	300	400	600	2400	3000	3400	3600	4000
Response (upper) (dB)	40	40	2	1.5	0.7	0.7	1.1	3	40	40
Response (lower) (dB)	0	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	0

Additionally, any connection will usually contain two local lines comprising a random variety of cable types/characteristics.

The nominal loss/frequency response limits of the range of local lines can be represented by between 1 km and 9 km of 0.5 mm copper cable with nominal characteristics of 168 Ω/km and 50 nF/km (attenuation at 1600 Hz of 1.7 dB/km) and are shown in Table 6.

	Insertion Loss (dB)				
Frequency (Hz)	**200 Hz**	**400 Hz**	**1600 Hz**	**3200 Hz**	**4000 Hz**
Upper limit (dB)	5.1	7.1	14.2	20.1	22.5
Lower limit (dB)	0.4	0.6	1.2	1.7	1.9

Table 6: Local Network Cable Insertion Loss/Frequency Response

Note: ***Values applicable to end-to-end characteristics apply only to calls connected wholly within the BT network when measured between 600 Ω resistances.***

9.7. Relative Group Delay

In the BT PDPL end-to-end Core IP network, relative group delay has become less of a significant parameter in relation to the transmission of voiceband data.

9.8. Terminal Equipment Spectral Power Requirements

To prevent undue interference with other users of the Openreach access network, terminal equipment should conform to the requirements of the "Specification of the Access Network Frequency Plan (ANFP) applicable to transmission systems used on the Openreach Access Network". This ANFP specifies Power Spectral Density masks (PSD) defining the maximum power for each frequency that may be injected into the line at the customer end of the local loop. Customers are advised to contact their terminal equipment provider on this issue to ascertain the compliance of their terminal equipment with the ANFP. SIN 375 [6] gives up to date information about the ANFP PSD masks, and where to locate the latest issue of the ANFP specification.

If interference is caused to other users of the Openreach access network, and this is identified as resulting from terminal equipment being non-compliant with the ANFP, Openreach will be required to take remedial action to remove the cause of the interference. This could ultimately result in the disconnection of the PDPL circuit from the non-compliant terminal equipment.

Equipment that has been approved under the UK terminal equipment approval regime that existed prior to the implementation of the RE&TTE Directive [7], which is transposed into UK law by SI 2000 No. 730 [8] and SI 2003 No. 1903 [13], is deemed to be compliant with the ANFP.

Home Phoneline Networking (HPN) equipment [i] (e.g. equipment designed to ITU-T Recommendation G.989.1 [9], Phone-line Networking Transceivers - Foundation) is likely to be compliant to the ANFP provided that the optional isolation filter that is strongly recommended in Recommendation G.989.1 is fitted to prevent the signals from the Home Phoneline Networking equipment leaking out via the PSTN NTP onto the Openreach access network.

9.9. Line Sharing

The PDPL service is an analogue voice & voice-band data service only. This service is provided over a metallic path of the Openreach product SOTAP for Analogue (*Single Order Transitional Access Product for Analogue*) [17]. There is *no option* available for *Line Sharing* and *no option* for an associated provision of a Broadband service access e.g. via Openreach SIN 346 Asymmetric Digital Subscriber Line services on the *same* physical line.

Note: The PDPL service does *not provide* any support for BT Redcare services.

9.10. Supplementary Services

NOTE: A *subset* of the Supplementary Services *currently* described in Openreach SIN 354 [2] Supplementary Services will be available on the BT PDPL network line Interface.

The Supplementary Services supported/Not Supported by PDPL are listed in the Table below as per reference [20]:

Supplementary Service **Name & Description**	**PDPL *Profile*** **Voice Band Data**	**PDPL *Profile*** **Mixed Mode (Voice + VBD)**

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[i] Equipment using customer premises extension telephone wiring to provide an internal data network within the customer's premises.

Calling Line Identity (Withhold) 141 *per Call*	Yes	Yes
Calling Line Identity (Release) 1470 *per Call*	Yes	Yes
Permanent (Withhold Number)	Yes	Yes
Caller Display	Yes	Yes
1471 Last Caller / Call Return (Press 3)	No	Yes
1475 Last Caller -Erasure	No	Yes
Ring Back When Free	No	No
Call Diversion: All Calls | On Busy | On No Reply	Yes	Yes
Outgoing Calls Barred (OCB)	Yes	Yes
Incoming Call Barring (ICB)	Yes	Yes
OCB International & Premium Rate Services (PRS)	Yes	Yes
OCB PRS	Yes	Yes
Anonymous Call Rejection	No	Yes
Choose to Refuse	No	No
BT Call Protect	No	No
Call Waiting	No	Yes
3-Way Calling	No	Yes
Reminder/Alarm Call	No	No
Call Sign	No	No
Voicemail	No	Yes
Callminder / (PremiumVoicemail) Message Waiting Indicator (MWI)	No	Yes
SMS (BT Text)	No	No
Administration OCB	Yes	Yes
Administration OCB International | Mobile | Premium Rate (PRS)	Yes	Yes
Administration OCB | International	Yes	Yes
Administration OCB International | Premium Rate (PRS)	Yes	Yes
Administration OCB | Mobile	Yes	Yes

Administration OCB | Premium Rate	Yes	Yes
Administration OCB Timeline 123 | Operator 118	Yes	Yes
Administration Incoming Call Barring (ICB)	Yes	Yes
Administration OCB (PIN Change/Reset)	Yes	Yes
COT & SNI & MCID	No	No
Network Controlled Calling	No	No
Route to Credit Control RTCC	No	Yes
Debt Management OCB	Yes	Yes
Debt Management OCB – (PRS)	Yes	Yes
Debt Management OCB International | PRS	Yes	Yes
Debt Management OCB International | PRS | Operator	Yes	Yes
Debt Management OCB International| PRS| Operator| Mobile	Yes	Yes
Debt Management OCB Timeline 123 | Operator 118xxx	Yes	Yes
Debt Management OCB International | Mobile | PRS	Yes	Yes
Temporary Out of Service (TOS) Debt Management	Yes	Yes
Temporary Call Forwarding/Diversion (TCD)	Yes	Yes
TOS Fraud Prevention	Yes	Yes
Warmline	No	No
Hotline (i.e. Warmline with Zero Delay)	Yes	Yes
Changed Presentation CLI	No	No
123 Speaking Clock	Yes	Yes
Tone to be Played when MGW loses connection to network	Yes	Yes
Earth Calling Lines	No	No
Remote Call Forwarding	No	No

Admin Ring Back Inhibit	No	No
Call Announcement (Call Number Intercept)	No	No
Admin Indirect Access (Phone Cards) Call Barring (for BT Basic)	No	No

NOTE: The PDPL Service will not support any form of carrier pre- selection (CPS) or indirect access (IA) services. Ofcom removed BT's obligation to offer carrier pre-selection (CPS) and indirect access (IA) (*where BT's retail arm provides the access line*) in its document: Review of the fixed narrowband services markets dated 26th September 2013 [16].

9.11. Follow-On Call

To initiate a follow-on call the BT network interface will recognise a break in the loop current applied at the NTP, where the DC current falls to 1 mA or less for a time period in excess of 3s.

10. ROUTINE TESTING OF THE LOCAL NETWORK

Openreach has for many years carried out automatic test routines on its local line plant. In recent years the frequency of testing PSTN lines has increased to a level approaching once every 24 hours in order to maintain the high levels of customer service expected of a modern network. This frequency of testing will apply equally to BT PDPL lines.

In the early 1990's problems were encountered with telephone bells or tone callers responding to the line conditions arising from these tests. To address this problem SIN 156 was published that outlined the conditions that might be expected during routines and as a result significant improvements have been made to apparatus that have almost eliminated the problems.

The following information replaces SIN 156 and is to maintain awareness of the need to consider the effect of Openreach's test routines during the design of new apparatus to avoid consumer dissatisfaction.

The Line Test Systems operated by Openreach are of proprietary origin, the technical design of which is the Intellectual Property of the vendors. However, the following information is representative of the conditions that may be expected and should be considered during the design of new apparatus.

10.1. Line Test Conditions

The conditions below may be applied in accordance with table 7.

a) Up to 50 Volt battery (Positive and Negative with respect to earth) with a source resistance between 0 and 120 kΩ;
b) Earth via a source resistance of between zero and 120 kΩ;
c) Open circuit greater than 10 MΩ;
d) AC voltage to be less than 25 volts peak to peak at no more than 30 Hz, either balanced or longitudinal.

The sequence of these conditions is not as important as the control of transients while switching between tests. The following general conditions apply.

i) Exchange voltage disconnected;

ii) Transient current limited to 1.0 mA while switching between tests;
iii) Transient settling time between tests of up to 1 second;
iv) Total test time of up to 18 seconds;
v) Exchange voltage reconnected.

Table 7: Line Test Conditions

'A' Wire	**'B' Wire**
Earth	Battery
Battery	Earth
Open	Battery
Battery	Open
Open	Earth
Earth	Open
Battery	Battery
Earth	Earth
Open	Open
AC	Battery
Battery	AC
Earth	AC
AC	Earth
AC	Open
Open	AC
AC	AC

10.2. Future Plans

Openreach is evaluating the use of automatic test routine equipment that removes the off-line DC voltage for a period of greater than the 18 second period described in 10.1 Line Test Conditions. If it is decided to deploy such equipment then this SIN will be re-issued to give advance notice of any changes to the characteristics described in 10.1.

10.3. Enquiries

Contact details for enquiries about routine testing of the local network can be found at https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

11. PDPL CPE Terminal Equipment Compatibility

If you as a CPE manufacturer, supplier or telecoms services provider are unsure if a specific device will work with our service, you can visit our Digital Services Test Laboratory at Adastral Park in Ipswich. Here you will be able to connect your device prior to migration to one of our PDPL lines for testing. If you want to arrange a visit for CPE compatibility testing please contact your BT account manager.

Note: (*BT will not guarantee that any device connected post migration will be supported.*)

12. Glossary

ADSL	Asymmetric Digital Subscriber Line
ANFP	Access Network Frequency Plan
CPE	Customer Premises Equipment
DEL	Direct Exchange Line
DP	Distribution Point
EC	European Commission
ETSI	European Telecommunications Standards Institute
HPN	Home Phoneline Networking
IDC	Insulation Displacement Connector
MGW	Media Gateway
NTE	Network Termination Equipment
NTP	Network Termination Point
REN	Ringer Equivalence Number
PDPL	Pre-Digital Phone Line
PSD	Power Spectral Density
PSTN	Public Switched Telephone Network
RE&TTE	Radio Equipment and Telecommunications Terminal Equipment
SI	Statutory Instrument
SIN	Suppliers' Information Note
SIP	Session Initiation Protocol
SOTAP	Single Order Transitional Access Product for Analogue.
TIG	Technical Interface Guide

12. References

[1]	British Standards document BS6312, 1994 - Connectors for analogue telecommunication interfaces. Part 1. Specification for plugs
[2]	SIN 354 – Openreach Public Switched Telephone Network (PSTN):Technical Characteristics of The Supplementary Services Available On The Analogue Line Interface.
[3]	SIN 350 - Openreach Public Switched Telephone Network (PSTN): Network Tones And Announcements.
[4]	ETSI ETS 300 001, 4th Edition January 1997. Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analogue subscriber interface in the PSTN.
[5]	ITU-T Recommendation G.712, 11/96 - Transmission performance characteristics of pulse code modulation channels.
[6]	Openreach SIN 375 – Terminal Equipment Spectral Power Requirements.
[7]	RE&TTE Directive - Directive 1999/5/EC of the European Parliament and of The Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity, OJ L91, 7.4.1999, p.10.
[8]	Statutory Instrument 2000 No. 730. The Radio Equipment and Telecommunications Terminal Equipment Regulations 2000.
[9]	ITU-T Recommendation G.989.1, 02/01 - Phone-line Networking Transceivers – Foundation.
[10]	Openreach SIN 346 - BT ADSL Interface Description.
[11]	ITU-T Recommendation V.90, 09/98 - A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream.
[12]	ITU-T Recommendation V.34, 02/98 - A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.
[13]	Statutory Instrument 2003 No. 1903. The Radio Equipment and Telecommunications Terminal Equipment (Amendment) Regulations 2003
[14]	Statutory Instrument 2003 No. 1904. The Electronic Communications (Universal Service) Order 2003
[15]	Openreach SIN 498 - Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC) Service and Interface Description
[16]	Ofcom: Review of the fixed narrowband services markets Statement on the proposed markets, market power determinations and remedies. 26th September 2013
[17]	Openreach: SIN 349: SIN 349 - Metallic path facility (MPF) - interface description
[18]	Openreach SIN 351: Public Switched Telephone Network (PSTN) Technical Characteristics of the Single Line Interface.

[19]	Openreach SIN227: Calling Line Identification Service: Service Description.
[20]	Voice USO Business Requirements Specification v0.3 ML (BT internal document)

For further information or copies of referenced sources, please see document sources at https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

13. History

Issue 1	November 2024	Originally derived from SIN 351 (from which much information was common). Other sources of Supplier Specific technical information relating to the PDPL MGW Platform and Application Server (BT/EE IMS Application Server. BT internal documents referenced: Voice USO Media Gateway (MGW) Technical Architecture Design. Voice USO Business Requirements Specification v0.3 ML

Annex A: Call Arrival INDICATION (Ringing)

Significance	**Cadence** **(± 20 %)**
1) Standard Ringing	0.4 s on 0.2 s off 0.4 s on 2 s off

Note 1: The signal frequency of Standard Ringing and Distinctive Ringing is 25 Hz +1 Hz, -5 Hz.

Note 2: Ringing Cadence does not necessarily coincide with ring tone cadence.

Note 3: Suppliers should ensure that devices will not be adversely affected should ringing be applied to them.

Annex B: Analogue Data Transmission

Successful data transmission

The BT PDPL service was *primarily* designed for voice traffic. However, it is possible to carry other analogue signals on *a* ***reasonable endeavours' basis.*** As indicated previously in this SIN the PDPL supports two service Profiles "Mixed (Voice & Voice Band Data) and Voice Band Data (VBD). Digital data may be sent over the PDPL interface using suitable analogue modulation equipment (modems). Modems are generally designed to obtain the best performance in the prevailing conditions, and the nominal maximum rate for a particular modem can usually only be attained under ideal conditions. These are not always achievable in practice, even though the connection may be fully acceptable for speech. The maximum data rate attainable may therefore vary according to the characteristics of an individual connection, and at any moment in time. For a specified connection, the actual data rate achieved will also depend on the characteristics of the modulation devices, for example the transmitted power level and the modems' tolerance of errors.

Because data transmission performance is subject to many uncontrollable variables, BT does not guarantee data rates over the PDPL network.

BT does, and will continue to, comply with its Universal Service Obligation and with European directives.

Annex C: Further Sources of Related Information

BT's Network has been designed to support terminal equipment that meets the UK 1992 approval regime.

British Standard	Title	Date
'1992 Standard Set', also known as the 'Frozen Set'	PD 6560; BS 6317; BS 6320; PD 6561; PD 6571; PD 6562; PD 6563; PD 6564; PD 6565; PD 6566; PD 6567; BS 6833 Part 2; PD 6572.	1992

A number of BT SINs are useful in providing background information about the BT network interface.

SIN Number	Title
227	BT Analogue Caller Display Service - Service description
242	CDS™ Calling Line Identification Service. TE Requirements Part 1 Idle State, Down Stream Signalling, Part 2 Loop State signalling
367	Characteristics of the BT Network: Electrical Safety & EMC

Guidance on one-way transmission delay can be found in the Recommended Standard for the UK National Transmission Plan for Public Networks, ND1701. This is published by the Network Interoperability Consultative Committee. For further information or copies of referenced sources, please see document sources at

http://www.btplc.com/sinet/Documentsource/index.htm.

– END –